

## **A COMPARATIVE ANALYSIS OF DIET QUALITY IN URBAN AND RURAL HOUSEHOLDS IN IBADAN ZONE OF OYO STATE, NIGERIA**

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### **ABSTRACT**

*Deficiency in both diet quality and diet quantity is today a global problem. This study has its foundation in the Lancasterian theory of consumer choices as the basis for the study of protein intake in Nigeria. The objectives of this study are to determine the level of protein intake, estimate the expenditure elasticities for protein consumption, compare protein intake between rural and urban areas and examine the effect of location on protein consumption in the study area. Data for the study came from a sample survey of Ibadan zone of Oyo State, Nigeria. Multiple regression analysis was employed to analyze the data. Household nutrient intake functions were estimated under intercept and slope specifications. The total protein consumed by an average rural household (328.95gm) was more than that of an average urban household (268.52gm). The portion of protein from plant source of 54.08 gm for an average rural household was greater than the 51.1 gm available to the average urban household. This source does not satisfy the 70 gm/cap/day recommended intake by FAO (1985) for both the rural and urban areas. The result showed that overall per capita intake of 63.4 gm/cap/day of protein in rural area was greater than the 60.94 gm/cap/day for the urban area. The rural household per capita consumption of the nutrient was lower by 6.6 gm/cap/day than the recommended level while that of the urban area fell short of it by 9.06 gm /cap/day. The Intercept model produced four variables total expenditure ( $X_1$ ) in naira, household size ( $X_2$ ), (number) education of household head in years ( $X_3$ ) and education of wife in a monogamous household or sum of years, education of wives in a polygamous household. ( $X_4$ ) those were positive and significantly related to the consumption of protein. The household head's education variable ( $X_3$ ) was positive and significant. The location variable was negative and significantly related to protein consumption. It indicated that the average rural household consumes more protein than the average urban household. The slope model showed that the variables total expenditure ( $X_1$ ) in naira, household size ( $X_2$ ), (number) education of household head in years ( $X_3$ ) and education of wife in a monogamous household or sum of years, education of wives in a polygamous household. ( $X_4$ ) were significant and directly related to protein consumption. The variable  $X_1$  interacted with the dummy was negative and significant indicating inverse relationship with protein consumption. This means that the elasticity of consumption of the nutrient with respect to  $X_1$  is greater for rural than for the urban household. That is, the elasticity value for the urban area was lower. The variables interacted with the dummy are positive. However, the interacted terms with household size ( $X_2$ ) and education of wives in a*

*polygamous household. ( $X_4$ ) were significant while that with education of household head in years ( $X_3$ ) was insignificant. This significance implies that the elasticity with respect to this variable is lower for the rural than the urban household. Based on the findings in this study it is recommended that nutrient consumption awareness campaign, and Nutrition education policies be put in place.*

**Keywords:** Diet quality, Protein Consumption, Rural and Urban Nigeria

## INTRODUCTION

Food is a basic necessity of life. It is however a combination of macro and micro nutrients (Adegbola, 1997). A balanced diet can be defined as one that contains all the six classes of food components namely: carbohydrate, protein, vitamins, mineral salts, fat and oil and water. Deficiency in both diet quality and diet quantity is today a global problem (Abdullahi and Aubert, 2004).

Nutrition is the study of how the body uses the nutritive substances or nutrients contained in foodstuff. Nutrients can be defined as the substances contained in the food, which the body needs to function properly (Aromolaran, 2004). The three functions of nutrients are to ; (i) provide energy (ii) ensure growth and (iii) protect the body. The lack of adequate nutrients in the right proportion in a diet results in malnutrition. Carbohydrates and Fats are macronutrients that provide energy. Energy is needed mostly for the functioning of essential organs such as the brain, lung and heart and for walking and running. Fats insulate the body. Also, fat-adipose tissues help to hold the body organs in position and to protect them against damage through physical shock. The main function of protein is to immune the body system against the environment. It also provides energy but this is not considered to be its major function.. Vitamins and minerals are nutrients that enhance the essential chemical reactions necessary to build up and maintain body defence mechanism against diseases and infection. Diet quality refers to the ability of foods to supply protein of high biological value and adequate supplies of other micro nutrients (Abdullahi and Aubert, 2004).

It is well-known that Nigeria's per capita intake of high quality animal protein is too low (Edusogie 1971; Olayide et al, 1972; Oyenuga, 1974; FAO, 1990). The health hazards of protein malnutrition have been well documented (FAO, 1965). According to Awosanmi, (1999); there is an increasing evidence of high infant mortality, low resistance to diseases, poor growth and development, mental retardation which comes as a result of inadequate protein in the diets of most Nigerians. According to FAO (1990), the diets of the people of the tropical zone and Nigeria (Tewe, 1993) are usually protein poor.

### **Statement of Problem**

Nutrition refers to both the outcome and the process of providing the nutrients needed for health, growth, development and survival. The need for the supply of the right quantity and mix of essential nutrients to the body arises because nutrients have been found to have a strong empirical linkage with both human health and productivity (Aromolaran, 2004).

Malnutrition problems in the developing countries can be examined in terms of the macronutrients (calorie and protein intake) as well as the inadequate consumption of micronutrients (Abdulai and Aubert, 2004). The inadequate intake of these nutrients hinders healthy growths, affects the individual's ability to undertake productive activities, and lowers the utilization of other nutrients (Aromolaran, 2004).

Malnutrition and under nutrition are still problems of unacceptable proportions in many developing countries (Abdulai and Aubert, 2004). Global surveys revealed that nearly one billion people mostly in developing countries (including Nigeria) are chronically undernourished, lacking sufficient food to live healthy and active lives (Addo, 2001). A healthy and nutritionally well-fed population is indispensable for attaining economic growth and development objectives of a nation yet there have been persistent reports of widespread malnutrition among Nigerians. Malnutrition in Nigeria has been linked to food shortages, both in terms of the quantity available and access to the right type (quality) of food to provide balanced diets (Durojaiye, 2001). A nation that is burdened with under nutrition will have to make do with a labour force that is lacking in strength and capacity to be fully productive (Belli, 1971).

The problem focus of this study is to compare the actual intakes of proteins with the recommended intakes so as to determine the nutrient intake gap for urban and rural Nigeria. The quantification of the macronutrient (protein) imbalance for the areas is deemed to be of policy relevance.

### **Objectives of the Study**

The specific objectives of this study were to:

1. Determine the level of protein intake in the areas of study;
2. Estimate the expenditure elasticities for protein consumption in the areas;
3. Compare protein intake between rural and urban areas;
4. Examine the effects of location on protein consumption in the study area;

### **Theoretical Framework**

In consumer theory, demand functions are derived by considering a model of preference maximizing behaviour coupled with underlying economic constraints. This study has its foundation in the Lancaster (1966) theory of consumer choices. This postulates that consumers choose attributes of goods (e.g. the nutrient composition of food) rather than the goods (e.g. the food commodities) themselves. In other words, utility is provided by the attributes a good has instead of the

good *per se*. Homa *et al.*, (2005) notes that individual preferences determine the relative weights given to the various attributes when choices are made; and, that the relationship between goods and attributes, and among attributes is objectively determined and determined by the consumption technology. The consumption technology here is the available food commodities that are consumed by household members in a drive to maximize their welfare (utility).

Building on the Lancasterian theory, household demand for food can be modelled as the sum of utilities that attributes or food nutrients generate to a consumer. Desire for these attributes (consisting of the energy, protein, vitamin and mineral composition, among others), form the basis for consumers' choice of bundles of food commodities they purchase subject to their budget constraints. The individual's preferences that determine the relative weights given to the desired composition of various nutrients in food purchases can be determined. These can then be hypothesised to consist of household characteristics like income, size, age and sex composition, as well as educational attainment of the household head, among others.

## METHODOLOGY

### Area of study

The area of study is the Ibadan zone of Oyo state. Ibadan is the largest city in West Africa. It has a population of over 2 million inhabitants (Census, 2006). It is a densely populated area. The large population provides a ready market for most commodities. Public offices and private businesses offer job opportunities for the population both in the formal and informal sectors. The Ibadan zone is characterized by a clear cut urban-rural nexus and rural-urban linkages. The five (5) Local Government Areas (LGAs) making up the former Ibadan Municipal Government (IMG) are classified strictly as urban LGAs. These LGAs are thus conceptualized within the context of an urban economy.

According to Ricardo (1817) an urban economy is that which is industrialized, commercialized and provides adequate infrastructural facilities (physical, social and institutional). Such an area must have at least 10 out of the 15 other listed characteristics. (Falusi, 1995). The remaining six (6) LGAs are classified strictly as rural LGAs. They are thus situated within the rural economy. This is because most farm households and agricultural activities (livestock, fisheries and crop production) are carried out within the peri-urban rural setting of Ibadan due to land scarcity in Ibadan.

### Method of data collection

Data for the study came from a sample survey of the area of study. The first stage of sampling, in the multistage procedure used, was the selection of the five urban and six rural LGAs. In the second stage, the list of all villages/towns within each LGA was obtained from the State's Ministry of Local Government. From this list, 6 villages/towns were randomly selected for a total of 30 towns and 36 villages. The third stage involved randomly selecting five farm households in each

village and six households in each town for a total of 180 households in the rural LGAs and 180 households in the towns. As a result, each area produced 180 household heads. A total of 280 farm wives and 210 urban house wives were recorded. Polygamy in some of the households is responsible for this situation. The data were collected through the use of a structured questionnaire.

Each of the households in the sample was visited twice in a month over a two-month period, and pre-tested structured questionnaire was used to elicit information on the household's socio-economic characteristics - age, sex, education, occupation, average monthly income, marital status of the selected members, and the household size at the first visit. In every visit, data on households' expenditure on (or worth of) various food commodities consumed jointly as well as individually by the household within the last 24 hours of each visit were obtained. In addition, the unit cost (price) per kilogram of the various foods items was obtained.

## METHODS OF DATA ANALYSIS

### Determination of food Nutrient Composition

A nutrient composition table (Oguntona and Akinyele, 1998), that displayed the nutrient composition of various food commodities in Nigeria was used to estimate the protein contents of foods consumed by the household in the sample as follows:

$$Q_i^k = \sum a_{ij}Z_j, \quad \text{for } j=1,2, \dots,k$$

Where:  $Q_i^k$  = total daily intake of nutrient k by the ith households,  $a_{kj}$  = composition of nutrient k per unit (kg) of the j<sup>th</sup> food commodity, and  $Z_j$  = quantity of the j<sup>th</sup> food commodity consumed per head per day by the referenced household

### Determination of Food Quantities

Given that, it is not be feasible to directly measure the quantity of the various food items consumed jointly and individually by members of the sampled households, these quantities were approximated using the expenditure and unit cost (price) data as;

$$Q_i = E_i / p_i$$

Where:  $q_i$  = estimated quantity (kg) of the ith food commodity consumed by an household,  $E_i$  = the expenditure on the ith food commodity ( $\text{^}$ ), and  $p_i$  = the unit cost or price ( $\text{^}$  per kg).

### Multiple Regression Analysis

Multiple regression analysis was employed to analyze the data. Household nutrient intake functions are estimated under intercept and slope specifications. Two studies that applied these models are Rola et al (1996) and Rahji and Falusi (2005). For the theoretical formulation of the models; see Kmenta (1971: 409-422).

The estimating equations are

**The Intercept Model**

$$\ln E_i = b_0 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 D \dots\dots\dots (1)$$

In this formulation, the dummy (D) affects the constant term only.

For rural household, D=0. If D=0, equation (1) becomes

$$\ln E_i = b_0 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 \dots\dots\dots (2)$$

For urban household, D=1 and their equation is

$$\ln E_i = (b_0 + b_5) + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 \dots\dots\dots (3)$$

If  $b_5$  is positive, then the intercept of the urban household's equation is greater than the intercept for the rural household. This implies that urban household consumes more than the rural household counterparts.

If  $b_5$  is negative, the intercept of the urban household's equation is less than that of the rural household's. This indicates that the rural household consumes more than the urban household.

If the intercept ( $b_0$ ) is viewed as representing the subsistence household nutrient intake, this model implies that the intake level is affected by the location of the households consuming it. This implication is reflected by the coefficient of the location dummy variable ( $b_5$ ). The dummy variable thus combines the two locations and at the same time shows the difference between them. Such a difference is put forward as a hypothesis to be tested as:

$$H_0 : b_5 = 0 \quad H_1 : b_5 \neq 0.$$

**The Slope Model**

This is expressed as;

$$\ln E_i = a_0 + a_1 \ln X_1 + a_2 \ln X_2 + a_3 \ln X_3 + a_4 \ln X_4 + a_5 \ln(X_1 D) + a_6 X_2 D + a_7 X_3 D + a_8 X_4 D \dots\dots\dots (4).$$

Equation (4) is used to capture the possible difference between the values of the coefficients of the location dummy and explanatory variables. The aim is to find out whether location influences changes in the household intake of nutrients with respect to the explanatory variables. Note that the variable associated with  $a_5$ ,  $a_6$ ,  $a_7$ , and  $a_8$  is a product of the dummy variable (D) and the quantitative explanatory variables  $X_1$ ,  $X_2$ ,  $X_3$ , and  $X_4$ . Hence, observations on  $X_1 D$ ,  $X_2 D$ ,  $X_3 D$  and  $X_4 D$  will consist of zeros if  $D=0$  and  $X_1$ ,  $X_2$ ,  $X_3$  and  $X_4$  if  $D=1$ .

Hence for rural households, when  $D=0$  equation (4) becomes

$$\ln E_i = a_0 + a_1 \ln X_1 + a_2 \ln X_2 + a_3 \ln X_3 + a_4 \ln X_4 \dots\dots\dots (5).$$

For the urban households, when  $D=1$  the equation is

$$\ln E_i = a_0 + (a_1 + a_5) \ln X_1 + (a_2 + a_6) \ln X_2 + (a_3 + a_7) \ln X_3 + (a_4 + a_8) \ln X_4 \dots\dots\dots (6).$$

It follows that if  $a_5$  is positive, urban households consume more than the rural household. If, however,  $a_5$  is negative then the rural households consume more of the nutrient than the urban households at the margin. The same thing applies to  $a_6$ ,  $a_7$  and  $a_8$ . This model implies that the

effect of location leads to a difference in the elasticity of nutrient intake between the locations. The elasticities of nutrient intake by location are thus estimated in this model. The following hypotheses are to be tested for the model:

$$\begin{array}{llll} H_0; a_5 = 0 & H_0; a_6 = 0 & H_0; a_7 = 0 & H_0; a_8 = 0 \\ H_1; a_5 \neq 0 & H_1; a_6 \neq 0 & H_1; a_7 \neq 0 & H_1; a_8 \neq 0. \end{array}$$

### Variables

The individual's preferences that determine the relative weights given to the desired nutrients in food purchases by consumers can be hypothesized to depend on household characteristics of income, household size, education of household members, by gender, age, and gender of household head, age and gender are not easily amenable to and for policy formulation, while there is a controversy as to the use of income in such an analysis. Expenditure is more preferable in the literature.

Friedman (1957), argues that total expenditure is a better explanatory variable than income in consumption analysis. It is believed that total expenditure is more closely related to permanent economic status of the households than income. Even then, it is argued that income is more likely to include transitory and unexpected elements (Klein, 1962). More so, in the rural setting, farm income is known to be very low (Ojo, 1991). Hence, the impact of the home-consumed portion of total farm output may be lost if income is used.

Expenditure elasticities from a cross-section sample are higher than income elasticities for various reasons (Koutsoyiannis, 1977). One, expenditures of households in higher income brackets are high. Two, total expenditure is generally smaller than income, especially for urban households, as part of the income is often assumed to have been saved. Thus, the denominator of the expenditure elasticity tends to be smaller than that of the income elasticity of consumption. Hence, expenditure elasticities tend to be higher than income elasticities.

Tobin (1980), Crockett (1960), and Houthaker, 1957) are among the first to use household size in consumption analysis. Others are Rahji (1996, 2000) Becker (1965, 1976), Muth (1966) and Lancaster (1966a, 1966b) extended the applicability of the theory of consumer and motivated the incorporation of household socio-economic characteristics of education of household members via the household production from work into the analysis.

The use of per capita expenditure on food items on per capita total expenditure (Olaloye, 1989, Nweke et al, 1994) can be criticized on two grounds. First, biases are introduced into the elasticity estimates by the use of arithmetic means in the logarithmic relationship. Secondly, the consumption function based on per capita formulations ignores the possibility of economies and/or diseconomies of scale in household consumption (see Iyengar et al; 1965; Rahji, 2000).

On the basis of their observations, in this study, the consumption of macronutrients (proteins)  $E_i$  = the expenditure on the  $i$ th food commodity ( $\wedge$ ) is hypothesized to be a function of total expenditure ( $X_1$ ) in naira, household size ( $X_2$ ), (number) education of household head in years ( $X_3$ ) and education of wife in a monogamous household or sum of years, education of wives in a polygamous household. ( $X_4$ ) and the location variable ( $D$ ) if urban =1 otherwise = 0.

## RESULTS AND DISCUSSION

### Protein Contents of Food Consumed

Table 1 presents the protein content of various food commodity consumed per-caput as well as aggregate household by an average household in the study area.

**Table 1: Analysis of the protein Content of the Food Consumed**

Commodity Group	Total quantity Consumed by an average household (g)		Per-caput consumption by an average member (g)		t- value
	Rural	Urban	Rural	Urban	
Cereal	110.85 (9.67)	108.98 (10.13)	21.99	25.76	-2.44**
Legume	98.43 (16.48)	84.37 (9.58)	19.53	19.95	-2.94
Tuber	58.41 (7.79)	25.12 (2.68)	11.59	5.94	7.27***
Fruveg	2.20 (0.49)	0.90 (4.89)	0.44	0.21	4.57***
Animal	44.44 (5.34)	39.88 (4.89)	8.82	9.43	-0.81*
Others	0.40 (0.09)	0.32 (0.08)	0.08	0.08	0.24
<b>Food items</b>	<b>314.73 (27.0)</b>	<b>259.57 (20.36)</b>	<b>62.45</b>	<b>61.36</b>	<b>0.19</b>

Source : Data Analysis. 2013

**Note:** Figures in parentheses are the standard deviations of estimate.

\*\*\* significantly different at 1%,

\*\* significantly different at 5%,,

\* significantly different at 10%.

Table 1 show that a typical rural household derived significantly more protein from tuber and fruveg and significantly less protein from cereal and animal as compared to an average urban household. Also, the protein content of total food consumed and per-caput consumption in the rural area was more (314.73g and 62.45g respectively) than that consumed in the urban area. However, the per-caput protein consumption fell in both the rural and urban areas short of the

critical human body requirements for an active and productive life, which was put at 70g/cap/day by FAO, 1985.

Moreover, 50 percent of the critical protein requirement was recommended to come from animal sources (FAO, 1985) and this was put at 35g/cap/day.

The total plant and animal protein in both rural and urban are 53.55g/cap/day, 51.86g/cap/day and 8.82g/cap/day, 9.43g/cap/day respectively. These figures confirm the fact that a lot of people derive their protein largely from vegetable sources (plant protein) which are inadequate compared to what animal sources supply, in that 69 percent of total protein consumed should come from animal which contain greatest amount of protein (Olayide, 1982).

The plant protein consumed was more than the recommended protein requirement for human body per day (i.e. 35g/cap/day), while the animal protein consumption level for rural and urban households, on average were not up to the 35g/cap/day recommended per day for human development or active and healthy life.

### Comparison of Protein intake between Rural and Urban Areas

**Table 2 : Results of the Protein Consumption Intercept Model**

Variables	Parameters	t-values
lnX <sub>1</sub>	0.6823*** (0.1610)	4.2379
lnX <sub>2</sub>	0.4791** (0.2105)	2.2760
lnX <sub>3</sub>	0.1362* (0.0795)	1.7132
lnX <sub>4</sub>	0.2185** (0.1009)	2.1655
D	-0.2643*** (0.0609)	4.3399
lnA	2.0151	

Source : Data Analysis. 2013

\*\*\* significant at 1% \*\* significant at 5% \* significant at 10%

R<sup>2</sup> = 0.7053 R<sup>2</sup> = 0.7034 F = 169.4445 N = 360

Table 2 contains the result of the estimate Intercept model for protein consumption. The results revealed that the explanatory variables are each significantly different from zero. The variables total expenditure (X<sub>1</sub>) in naira, household size (X<sub>2</sub>), (number) education of household head in years (X<sub>3</sub>) and education of wife in a monogamous household or sum of years, education of wives in a polygamous household. (X<sub>4</sub>) has direct influence on the consumption of protein. Increases in these variables would lead to increases in the consumption of the nutrient. The location dummy variable is negative and highly significant. This result implies that the intercept of the rural households is higher than that for the urban households. Thus, rural

households consume more protein than the urban households. The alternative hypothesis that  $a_5$  is not equal to zero is accepted. The  $R^2$  value of 0.7053 indicates a good fit for the estimated model. The variables in the model explained about 70 % of the variation in the nutrient intake by the households.

**Table 3 : Results of the Protein Consumption Slope Model**

Variables	Parameters	t-values
lnX <sub>1</sub>	0.7123** (0.2594)	2.1460
lnX <sub>2</sub>	0.5381** (0.2061)	2.6109
lnX <sub>3</sub>	0.3462 (0.2132)	1.6238
lnX <sub>4</sub>	0.4157** (0.1858)	2.2374
lnX <sub>1</sub> D	-0.2433*** (0.0582)	4.1804
lnX <sub>2</sub> D	-0.2152* (0.1292)	1.6656
lnX <sub>3</sub> D	0.1206 (0.0816)	1.4779
lnX <sub>4</sub> D	0.1453** (0.0552)	2.6319
lnB	3.0268	-

Source : Data Analysis. 2013

\*\*\* significant at 1% \*\* significant at 5% \* significant at 10%

$R^2 = 0.8611$   $R^2 = 0.8591$   $F = 271.9997$   $N = 360$

Table 3 shows the results of the estimated slope model. The expenditure variable ( $X_1$ ), household size ( $X_2$ ) and sum of years of wife/wives education ( $X_4$ ) are positive and significant. The household heads` education variable is also positive but insignificant. The interaction dummy variable for  $X_1$  is negative and significant .This means that its elasticity of consumption for the rural households is higher than for the urban households. The other three interaction terms are positive. However, only the coefficients of those attached to  $X_2$  and  $X_4$  are significant. This result means that the elasticity of protein intake is higher for the rural household. The  $R^2$  value of 0.8611 indicates a good fit for the model. Thus, all the variables collectively explained some 86 % variation in protein intake by the households.

### Summary of the Study

On a comparative basis, there are significant differences in consumption in terms of protein between the rural and urban areas.

- The total protein consumed by an average rural household (328.95gm) was more than that of an average urban household (268.52gm)
- The portion of protein from plant source of 54.08 gm for an average rural household was greater than the 51.1 gm available to the average urban household
- This source did not satisfy the 70 gm/cap/day recommended intake by FAO (1985) for both the rural and urban areas.
- The result showed that overall per capita intake of 63.4 gm/cap/day of protein in rural area was greater than the 60.94 gm/cap/day for the urban area.
- The rural household per capita consumption of the nutrient was lower by 6.6 gm/cap/day than the recommended level while that of the urban area fell short of it by 9.06 gm /cap/day.

#### **Intercept models**

- Four variables  $X_1$ ,  $X_2$ ,  $X_3$  and  $X_4$  are positive and are significantly related to the consumption of protein. There is thus a direct relationship with these variables and the consumption of the nutrient..
- The household head's education variable ( $X_3$ ) was positive but significant.
- The location variable was negative and significantly related to protein consumption. There is an inverse relationship. As defined, it implies that the average rural household consumes more protein than the average urban household.

#### **Slope model**

- The variables  $X_1$ ,  $X_2$ ,  $X_3$  and  $X_4$  were significant and directly related to carbohydrates consumption..
- The variable  $X_1$  interacted with the dummy was negative and significant indicating inverse relationship with protein consumption. This means that the elasticity of consumption of the nutrient with respect to  $X_1$  was greater for rural than for the urban household. That is, the elasticity value for the urban area was lower.
- The variables  $X_2$ ,  $X_3$  and  $X_4$  interacted with the dummy were positive. However, the terms with  $X_2$  and  $X_4$  were significant while that with  $X_3$  is insignificant. This significance implies that the elasticity with respect to this variable is lower for the rural than the urban household.
- These results indicated the differences in the elasticities of protein consumption by rural and urban location.

#### **Policy implications**

- Household nutrition awareness and campaign by Home Economics section of Agricultural Extension Department, Ministry of Agriculture and Natural Resources on a national basis by rural and urban settings is called for.
- Public enlightenment about macro and micro- nutrients by food companies such as Foodco, Tantalizer, Mr. Biggs, Nestles, Cadbury etc for healthy living should be part of the corporate responsibility of these companies.

- Production of nutritionists and sensitizing campaign by the Department of Human Nutrition of Universities in their catchment areas in Newspaper and electronic media.
- Radio/ TV station to have special programmes on nutrition like the Magic kitchen, Royco kitchen, Knorr, etc.
- Nutrition education from primary through secondary school for both male and female pupils/students.
- Pre and Post natal clinics and nutrition education for both pregnant and nursing mothers as development programmes and part of the development process

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